APPENDIX 12

RHIC UTILITIES

I. General

A 10 inch water main and ductbank system which run at the outside of Ring Road provide water, electric power and communication requirements to the six experimental structures and associated sextants. Heating, ventilating air conditioning, dehumidification, sewage, emergency power and compressed air systems are provided locally for each experimental structure and associated sextant.

Similarity, the experimental halls are provided from the Laboratory domestic water system (with provisions for additional supply for specific equipments), the 13.8kV electrical power system and individual HVAC and emergency power systems.

The Collider Center receives power from its own substation, domestic water supply with water effluent discharge to the BNL sanitary sewage system.

The Cryogenic facility utilizes several 13.8kV primary substations for the compressors and refrigerators. Water from the domestic system is used for makeup to the cooling tower.

With the exception of the Collider Tunnel these other principal facilities are equipped with either preaction or wet pipe sprinkler systems.

II. Heating, Ventilating, Air Conditioning and Dehumidification

1. Tunnel Dehumidification

Each sextant is served by a dedicated dehumidification system consisting of an air handling unit comprised of filters, cooling coil, fan and electric reheat coil. The supply air ductwork is located at the apex of the magnet enclosure with air outlets every 100 ft for the length of the sextant. A point return air opening near the mechanical equipment room returns the air to the system via a fan.

Similar type systems are provided for the experimental areas. The magnet enclosure systems provide approximately 2000 cfm per sextant (one air change about every 2 hours). Water vapor is condensed across the cooling coil and heated above the anticipated dew point of the tunnel wall temperature (52-55^0 F). The system operates constantly with dew point sensor in the return air activating the refrigeration and reheat cycle as required.

2. Alcove Power Equipment Room Cooling

Each of the three rooms per sextant is provided with a 2000 cfm fan and ductwork which draws cool air from the magnet enclosure and across the electronic equipment and then back to the magnet enclosure. A room thermostat activates the fan should the system prove inadequate, a split type refrigeration system will be provided.

3. Tunnel Emergency Exhaust System

The system will be modified to provide mechanical exhaust from high points at each of the three alcoves per sextant as well as high points at the ends of the sextants. ODH sensors will activate associated exhaust fan(s). Outside make-up air will be introduced through various intake stacks. The intake stacks will not be provided with fans. The system will be configured to purge smoke. The emergency exhaust system will be monitored at by the Personnel Safety System. The fans will be connected to the emergency power loop.

4. Experimental Hall Heating, Dehumidification and Ventilation

a) Design criteria for the dehumidification are similar to the "Tunnel Dehumidification" system.

b) Heating is provided by electric unit heaters at overhead doors and along exterior walls.

c) Each experimental hall is equipped with an emergency ventilation system which will change the air in the building every 5 minutes. This system takes its suction from low on each side of the hall and exhausts high at the back of the building. Initially, this system will be manually operated, however, provisions are made for adding automatic start at some later date, to be consistent with the safety analysis for each experiment.

d) In addition to the emergency ventilating system mentioned above, each experimental hall is equipped with two or more 30 inch diameter exhaust ducts with inlet 20 feet off the floor and discharge above the roof of the building. These ducts, when equipped with hoods and portable exhaust fans, will be used to ventilate detector equipment employing gases or liquids. Should this system not be capable of handling the situation then the emergency ventilating system is there as a backup. A three inch diameter high pressure vent system is located along each 30 inch exhaust duct to vent the pressure vessels using explosive gases or liquids.

5. Experimental Support Buildings

The experimental support and machine support areas are provided with separate HVAC units of sufficient air conditioning for people comfort and equipment cooling. Heating is provided with electric baseboard heaters.

III. Electrical Distribution

1. Tunnel Electrical Distribution

Electrical service is provided to the Collider Tunnel from 480 volt 3 phase distribution panels located at each Support Building. These distribution panels are fed from grounded delta-wye connected transformers. Each sextant of the magnet enclosure receives power from the source at each end of the sextant with approximately one half of a sextant's power obtained from the source at one end and the other one half or power obtained from the opposite end. The power is supplied from the Support Building distribution panels via 480 volt 3 phase feeder circuits to an equipment\emergency exit alcove distribution panel which provides branch circuits for the Collider Tunnel. The branch circuits are: 480 volt 3 phase receptacles spaced 150 apart; 208 volt, single phase, receptacles spaced 100 feet apart; 120 volt single phase receptacle spaced 50 feet apart; and 277 volt fluorescent lighting. Additional branch circuits are provided for connection of accelerator equipment. Emergency power is provided from 480 volt and 120/208 volt 3 phase distribution panels located at the equipment/emergency exit areas and powers emergency lighting. The emergency power is supplied by 150 kW diesel generators located next to unit substation.

Note: Diesel generator at 5 'o clock location is 300 kW.

2. Experimental Hall Electrical Distribution

This system consist of unitized 2.5 MVA substation, 13.8kV to 480 V delta-to-delta connected with ground fault alarms. In a delta secondary, a ground in a load circuit will not cause a loss to the system by a major fault. Such a system has been used in the AGS experimental areas since the machine has been in operation. Additional capacity has been included in the 13.8kV feeders such that a second substation could be added if needed.

Distribution within the experimental halls for all services, except heavy experimental needs, will be at 480/277 and 208/120 volts through the panel boards on the wall around the building. Heavy experimental power needs will be installed along with the detector to satisfy the particular needs of the detector.

The utility power for the Support Buildings and sections of the tunnel will also be fed from this substation.

Experimental hall interior lighting will be high-pressure sodium high bay type fixtures. Emergency lighting fed from an emergency power source shall have fixtures equipped with standby incandescent quartz lamps.

Emergency power requirements are per section III.1.

3. Cryogenic Facility Electrical Distribution

In the Helium Compressor Building two 12 MVA substations, 13.8kV to 4160 volts, supply power for the helium compressors. The building is serviced by one 1500 kVA substation, 13.8kV to 480 volts.

The Cryogenic Building is serviced by one 2.5 MVA substation, 13.8kV to 480 volts. The emergency generator will supply 480 volt 3 phase, power through an emergency power distribution panel located in the main mechanical equipment room.

All control instrumentation is fused and properly grounded. Three phase wye-connected loads are powered through properly sized fused disconnects.

4. Collider Center Electrical Distribution

This building is supplied from a 13.8kV/480/208/120 V substation. Building distribution is with dry tape transformers 480/208/129 V.

IV. Water Distribution

1. Tunnel Water Distribution

Domestic and fire protection water is supplied from the laboratory site distribution system through a 10 inch diameter water main which follows Ring Road. It connects to the Laboratory system at two locations; 5 and 6 o'clock. An 8 inch branch line feeds each experimental area and magnet enclosure sextant. A 3 inch line takes off from the 8 inch shortly before it enters the support areas. This 3 inch branch feeds domestic water to the support buildings and the experimental hall then connects to the 1 1/4 inch domestic water line within the tunnel.

The other branch (8 inch) continues into the utility room where it divides into two 4 inch branches. One branch feeds the fire sprinkler system in the support buildings and experimental hall and the second continues and feeds the loop fire standpipe system inside the magnet tunnels.

The 10 inch water main which circles Ring Road has 10 inch isolation valves on each side of the 8 inch branch to the experimental areas and an 8 inch isolation valve half way between the branches to the experimental areas. These 8 inch valves are provided with supervisory features which transmit to the fire house and security headquarters through the fire alarm system.

The 1 1/4 inch domestic water system extends around the ring with ½ inch valved take-offs every 60 ft and 3/4 inch hose bibs every 120 ft.

The 4 inch fire standpipe system extends around the magnet enclosure with 1 ½ inch fire valves located every 100 ft.

2. Experimental Hall Water Distribution

Domestic water is provided with distribution and valved drops around the inside periphery of the experimental buildings.

Equipment cooling water systems have not yet been included in any of the experimental halls because of the unknown quantity and quality of water required. It is planned to supply portable cooling water systems as needed as part of the detector installation.

3. Cryogenic Facility Water Distribution

Domestic and fire protection water in each building is furnished by a combination 8 inch ductile iron pipe water line extension from the 10 inch ductile iron pipe water main loop domestic water system adjacent to the Ring Road. There are no toilets in the facility.

4. Collider Center Water System

The supply water is from the BNL domestic water system.

V. Drainage System As Built

All Drainage systems will be brought into compliance with current environmental requirements.

1. Tunnel Drainage System

There are no toilet facilities within the magnet enclosure. Floor drains are furnished in the equipment/emergency exit alcoves, the RF alcove, the tunnels

that cross the open experimental area and in the beam dump tunnels. These floor drains discharge into local dry wells.

2. Experimental Hall Drainage System

Effluent water is returned to the recharge basins.

3. Cryogenic Facility Drainage System

There are no toilet facilities in the Cryogenic building or in the compressor building. Floor drains return to the recharge basin.

4. Collider Center Drainage System

All sanitary effluent water is pumped into the BNL sanitary sewer system.

VI. Compressed Air

An air compressor at each experimental support building connects to an 1 1/4 inch header which loops the entire magnet enclosure and the six experimental halls with ½ inch valved outlets every 60 ft.

Each system consists of an air compressor, receiver and refrigeration type air dryer and is rated for 9 scfm at 125 psig.

VII. Fire Protection and Detection

1. Tunnel Fire Detection and Protection

The fire detection system consists of heat and smoke detectors, manual stations, alarm bells, and annunciators. These systems will be monitored by the Site Fire Alarm System, consisting of the central supervising station at Fire/Rescue Headquarters and a remote station at Police Headquarters. All local system have been designed and installed in accordance with BNL ES&H Standard 4.4.0, "Local Fire Protection Signaling System", and appropriate National Fire Protection Association Standards, NFPA 72A, 72D, "Proprietary Protective Signaling Systems", and NFPA 72E "Fire Detectors".

For manual fire fighting a separate four inch standpipe system is provided with 1 ½ inch fire valve drops every 100 ft around the ring. This system is designated and installed in accordance with NFPA 14 "Standpipe Systems". Portable fire extinguisher will be provided in all magnet enclosures in accordance with NFPA 10 "Portable Fire Extinguisher". Halon extinguishing systems will be installed within equipment spaces

to protect sensitive electronic components. The mechanical equipment room is protected by a wet pipe sprinkler system. The escape hatches are provided with fire detection systems.

2. Experimental Halls

The experimental halls are protected with pre-action sprinklers. The pre-action water sprinkler system consists of a system of normally dry piping and normally closed sprinkler heads in the protected area, and a normally closed automatic valve. The operation of the valve is controlled by the fire alarm system. Provisions have been made in these systems to permit future extensions to obstructed areas under large experimental detectors. These systems are designated and installed in accordance with applicable National Fire Protection Association Standards, especially NFPA 13 "Automatic Sprinkler Systems".

A separate standpipe system is provided throughout all facilities in areas not easily accessible to exterior hose lines. This system is designed and installed in accordance with NFPA 10 "Portable Fire Extinguisher".

Water service and fire hydrants in the vicinity of each experimental hall are being provided in accordance with NFPA 24 "Outside Protection". Normally, one fire hydrant is located neat the support building and substation, and a second near the Ring Road. Hydrants are also installed around the Ring Road between the six experimental areas.

3. Compressor/Cryogenic Facility Fire Detection and Protection

Fire protection in each building is furnished by a wet pipe sprinkler system.

4. Collider Center Fire Detection and Protection

The first, second and fourth floors of the collider center have wet pipe sprinklers. The third floor, may contain a control room and computers. It currently has a pre-action pipe system above the raised floor which is activated by heat detection. Only a portion of the third floor in the Collider Center will be used as a control room should it be decided to do so. If necessary, the underfloor area of the control room section will be partitioned off and equipped with an appropriate suppression system, along with smoke detection.

The high bay addition to the Collider Center is provided with wet pipe sprinklers.

Fire detection is with temperature and rate-of-rise detectors. These will be tied into the Site fire alarm system.